

Amdt. dated Sept. 8, 2004
Reply to Office action of 07/08/2004

Serial No. 09/687,668
Docket No. SJO920000156US1
Firm No. 0037.0041

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

1. (Currently amended) A digital data processing system with improved access to information stored on a storage device, said system comprising a plurality of first nodes and a second node coupled to one another over a communications pathway, the second node being coupled to the storage device for determining meta data including block address maps to file data in the storage device, and the first nodes being configured for accessing file data from the storage device using said meta data, wherein said system comprises:

at least one first node that caches data including meta data for a file accessed by said first node;

a file application on said first node configured to get requested file data by accessing said cached data for the file; and

a file notification system that sends a file change notification to said first node indicating changes affecting the cached data, wherein the file application on the first node inspects the change notification and based on the change notification determines, whether to get the requested file data directly using said cached data or whether to get the requested file data from the storage device, wherein the storage device is a shared storage device between the said first node and the said second node, ~~whereby~~ wherein file accesses may be effected for an extended time with data locally cached at said first nodes of the digital data processing system.

2. (Original) The digital data processing system of claim 1, wherein the file application on said first node determines whether requested file data is subject to a change notification, and if so

Amdt. dated Sept. 8, 2004
Reply to Office action of 07/08/2004

Serial No. 09/687,668
Docket No. SJO920000156US1
Firm No. 0037.0041

makes a further determination whether cached data at said first node remains valid for the requested file data.

3. (Previously presented) The digital data processing system of claim 1, wherein the file application on said first node:
 - i) determines whether requested file data is subject to a change notification; and
 - ii) applies the cached meta data to directly mount the storage device to access the requested file when the cached data is not subject to a change notification.
4. (Previously presented) The digital data processing system of claim 2, wherein the file application on said first node further determines whether:
 - i) to directly access the file data by applying cached meta data associated with the file to directly mount the storage device, or
 - ii) to issue a file request to the second node for valid file access meta data or data.
5. (Original) The digital data processing system of claim 1, wherein the file notification system issues client-specific notifications limited to directories or portions of the file system that are to be accessed by each client.
6. (Original) The digital data processing system of claim 1, wherein the file notification system includes an interface layer with a storage system meta data controller for maintaining or acquiring administrative information pertaining to file size and storage locations.
7. (Original) The digital data processing system of claim 1, wherein the file notification system runs on the second node and interfaces with a file system meta data controller to detect changes in file system storage data, issuing a file change notice in response thereto.

Amdt. dated Sept. 8, 2004
Reply to Office action of 07/08/2004

Serial No. 09/687,668
Docket No. SJO920000156US1
Firm No. 0037.0041

8. (Original) The digital data processing system of claim 1, wherein the file notification system limits number of change notifications for a given file to first n changes that occur, where n is a positive integer.
9. (Original) The digital data processing system of claim 1, wherein the file application on the first node implements a decision algorithm to determine whether to apply cached data for a requested file when the requested file is subject to a change notification.
10. (Original) The digital data processing system of claim 1, wherein the file application on the first node intercepts reads and writes, and issues those directly to the storage device while exchanging messages over the communications pathway to permit coordinate file system management tasks performed by the second node.
11. (Original) The digital data processing system of claim 10, wherein the file system management tasks performed by the second node include publication of change data.
12. (Original) The digital data processing system of claim 1, wherein the file shared access coordination system runs on the second node and interfaces with or includes a file system meta data controller interceding in response to at least a first selected file access request applied thereto by a file application on a first node, and transferring data designated by that request between the first node and the peripheral device in accord with current meta data maintained by the file system pertaining to storage of that data on the storage device such that files may be directly transferred while maintaining file coherence and security.
13. (Previously presented) A digital data processing system, comprising
a first node and a second node coupled for communication:

Amdt. dated Sept. 8, 2004
Reply to Office action of 07/08/2004

Serial No. 09/687,668
Docket No. SJO920000156US1
Firm No. 0037.0041

a storage device coupled for communication with at least the first node; and
a cache memory coupled to and associated with the first node, the cache memory
storing administrative data pertaining to files on the storage device,
the second node notifying the first node of changes to administrative data pertaining to
files for which the cache memory stores administrative data.

14. (Original) A digital data processing system according to claim 13, wherein the storage
device is any of a disk drive, a "jukebox," other mass storage device or other mapped device.

15. (Original) A digital data processing system according to claim 13, wherein the
administrative data stored by the cache includes any of a physical storage map and at least a
portion of a directory pertaining to files on the storage device.

16. (Original) A digital data processing system according to claim 13, wherein the digital data
processing system comprises a network having a file management system, and a file application
on the first node applies administrative data in the cache memory pertaining to a file directly
mount the storage device.

17. (Original) A digital data processing system according to claim 13, wherein the digital data
processing system comprises a network having a file management system, and a file application
applies a notification of a change of administrative data pertaining to a given file by passing a
request for that file by the first node to the file management system.

18. (Currently amended) A method of sharing storage access in a digital data processing
system having a first node and a second node coupled for communication and a storage device
coupled for communication with at least the first node, such the method comprising the steps of:

Amdt. dated Sept. 8, 2004
Reply to Office action of 07/08/2004

Serial No. 09/687,668
Docket No. SJO920000156US1
Firm No. 0037.0041

 caching in a cache memory coupled to and associated with the first node, administrative data pertaining to files on the storage device;

 communicating, to the first node, changes to administrative data pertaining to files for which the cache memory stores administrative data; and

 determining, in the first node, whether to apply said cached data to reduce network communications for accessing a file ~~thereby reducing network communications~~.

19. (Currently amended) A digital data processing method for improved access to information stored on a storage device, wherein the system includes a storage device, a plurality of first nodes and a second node communicating over a communications pathway, the second node being coupled to the storage device for determining meta data for accessing file data in the storage device, and the first nodes being configured for accessing file data from the storage device using said meta data, wherein said method ~~is characterized by the steps of~~ comprises:

 caching meta data for a file accessed by said first node in a cache memory of said first node;

 providing a file application on said first node configured to get requested file data utilizing said cached data;

 storing file change notifications at said first node indicating changes that may affect the cached data; and

 determining, based on said change notifications, whether said file application may utilize the cached data for a requested file or whether said file application accesses the requested file from the storage device, wherein the storage device is a shared storage device between the first node and the second node.

Amdt. dated Sept. 8, 2004
Reply to Office action of 07/08/2004

Serial No. 09/687,668
Docket No. SJO920000156US1
Firm No. 0037.0041

20. (Currently amended) The method of claim 19, wherein the ~~step of~~ storing of file change notifications is effected by receiving a change list published by the second node and storing the change list.
21. (Original) The method of claim 19, wherein the file application
- i) determines whether requested file data is subject to a change notification, and
 - ii) applies the cached meta data to directly mount the storage device to access requested file when the cached data is not subject to a change notification.
22. (Original) The method of claim 19, wherein the file application on said first node operates
- i) to directly access the file data by applying cached meta data associated with the file to directly mount the storage device when said cached data is not subject to a change notification, or
 - ii) to issue a file request to the second node when said cached data is subject to a change notification.
23. (Original) The method of claim 19, wherein the file notifications are client-node-specific notifications limited to directories or portions of the file system that are to be accessed by each client.
24. (Original) The method of claim 19, wherein the file notification system runs on the second node operates with a file system meta data controller to detect changes in file system storage data and issue file change notifications in response thereto.

Amtd. dated Sept. 8, 2004
Reply to Office action of 07/08/2004

Serial No. 09/687,668
Docket No. SJO920000156US1
Firm No. 0037.0041

25. (Original) The method of claim 24, wherein the second node limits number of change notifications for a given file to first n changes that occur, where n is a positive integer.
26. (Original) The method of claim 19, wherein the file application on the first node implements a decision algorithm to determine whether to apply cached data for a requested file.
27. (Previously presented) The digital data processing system of claim 35, wherein the file notification system runs on the second node and sends the file change notification to the first node, wherein the first node is registered with the second node for receiving the file change notification, wherein the file change notification includes changes to the data and the meta data.
28. (Previously presented) The digital data processing system of claim 36, wherein the second node notifies the first node via a file notification system that runs on the second node and sends a file change notification to the first node, wherein the first node is registered with the second node for receiving the file change notification, wherein the file change notification includes changes to data and the administrative data stored in the cache memory.
29. (Previously presented) The method of claim 37, wherein a file notification system runs on the second node and sends a file change notification to the first node, wherein the first node is registered with the second node for receiving the file change notification, wherein the file change notification includes changes to file data and the administrative data stored in the cache memory.
30. (Previously presented) The method of claim 38, wherein a file notification system runs on the second node and sends a file change notification to one first node, wherein the one first node is registered with the second node for receiving the file change notification, wherein the file change notification includes changes to file data and the meta data.

Amdt. dated Sept. 8, 2004
Reply to Office action of 07/08/2004

Serial No. 09/687,668
Docket No. SJO920000156US1
Firm No. 0037.0041

31. (Previously presented) The digital data processing system of claim 1, wherein if the change notification indicates that changes that affect the cached data have been made, then the requested file data is obtained from the storage device coupled to the second node, wherein the storage device coupled to the second node is also coupled to the first node.

32. (Previously presented) The digital data processing system of claim 13, wherein in response to receiving, at the first node, a notification of the changes to the administrative data, the first node obtains a requested file data from the storage device, wherein the storage device is coupled to the first node and the second node.

33. (Previously presented) The method of claim 18, wherein in response to receiving a communication of the changes to the administrative data, the first node accesses the file from the storage device if the first nodes determines not to apply said cached data for accessing the file, wherein the storage device is coupled to the first node and the second node.

34. (Previously presented) The method of claim 19, wherein if the change notifications indicate that changes that affect the cached data have been made, then the requested file is obtained from the storage device coupled to the second node, wherein the storage device coupled to the second node is also coupled to the first node.

35. (Currently amended) The digital data processing system of claim 31, A digital data processing system with access to information stored on a shared storage device, said system comprising a plurality of first nodes and a second node coupled to one another over a communications pathway, the second node being coupled to the storage device for determining meta data including block address maps to file data in the storage device, wherein the storage device is a shared storage device between the first node and the second node, and the first nodes

Amdt. dated Sept. 8, 2004
Reply to Office action of 07/08/2004

Serial No. 09/687,668
Docket No. SJO920000156US1
Firm No. 0037.0041

being configured for accessing file data from the storage device using said meta data, wherein said system comprises:

at least one first node that caches data including meta data for a file accessed by said first node;

a file application on said first node configured to get requested file data by accessing said cached data for the file; and

a file notification system that communicates a file change notification to said first node indicating changes affecting the cached data, wherein the file change notification is communicated to the first node by publishing the file change notification via the second node, wherein the file application on the first node inspects the file change notification and if the file change notification indicates that changes that affect the cached data have been made, then the requested file data is obtained from the storage device, otherwise the requested file data is directly obtained using said cached data, and wherein file accesses may be effected for an extended time with data cached at the first nodes of the digital data processing system, wherein the change notification identifies changes to data associated with the second node, and wherein the change notification is communicated to the first node by publishing the change notification via the second node, wherein the storage device is directly coupled to the first node and the second node, and wherein the storage device is controlled by the second node.

36. (Currently amended) ~~The digital data processing system of claim 32~~ A digital data processing system, comprising:

a first node and a second node coupled for communication;

a storage device coupled for communication with at least the first node; and

a cache memory coupled to and associated with the first node, the cache memory caching administrative data pertaining to files on the storage device, wherein the second node notifies the first node of changes to the cached administrative data by publishing a change

Amdt. dated Sept. 8, 2004
Reply to Office action of 07/08/2004

Serial No. 09/687,668
Docket No. SJO920000156US1
Firm No. 0037.0041

notification that indicates the changes affecting the cached administrative data, and wherein if the change notification indicates that changes that affect the cached administrative data have been made, then a file data requested by the first node is obtained from the storage device, wherein a change notification identifies changes to data associated with the second node, and wherein the change notification is communicated to the first node by publishing the change notification via the second node, wherein the storage device is directly coupled to the first node and the second node, and wherein the storage device is controlled by the second node.

37. (Currently amended) The method of claim 33 A method of sharing storage access in a digital data processing system having a first node and a second node coupled for communication and a storage device coupled for communication with at least the first node, the method comprising:

caching in a cache memory coupled to and associated with the first node, administrative data pertaining to files on the storage device;

communicating, from the second node, a change notification to the first node, wherein the change notification indicates changes affecting the cached administrative data, and wherein the change notification is published by the second node to communicate the change notification to the first node;

receiving, by the first node, the communicated change notification;

determining, by the first node, whether to apply said cached administrative data for accessing a file;

accessing, by the first node, the file from the storage device if the first node determines not to apply said cached administrative data for accessing the file, wherein in response to receiving a communication of the changes to the administrative data, the first node accesses the file from the storage device if the first node determines not to apply said cached data for accessing the file, wherein the storage device is coupled to the first node and the second node.

Amdt. dated Sept. 8, 2004
Reply to Office action of 07/08/2004

Serial No. 09/687,668
Docket No. SJO920000156US1
Firm No. 0037.0041

38. (Currently amended) The method of claim 34; A method for accessing information stored on a storage device, wherein the storage device is shared by a plurality of first nodes and a second node, wherein the plurality of first nodes and the second node communicate over a communications pathway, wherein the second node is coupled to the storage device for determining meta data for accessing file data in the storage device, and wherein the first nodes are configured for accessing file data from the storage device using said meta data, the method comprising:

caching meta data for a file accessed by a first node in a cache memory of said first node;
providing a file application on said first node configured to get requested file data
utilizing said cached meta data;

storing file change notifications at said first node indicating changes that may affect the
cached data, and wherein said file change notifications are communicated to the first node by
publishing the file change notifications via the second node; and

determining, based on said file change notifications, whether said file application may
utilize the cached meta data for a requested file or whether said file application accesses the
requested file from the storage device, wherein if the file change notifications indicate that
changes that affect the cached meta data have been made, then the requested file is obtained from
the storage device coupled to the second node, wherein if the change notifications indicate that
changes that affect the cached data have been made, then the requested file is obtained from the
storage device coupled to the second node, wherein the storage device coupled to the second
node is also coupled to the first node.